

GNSS/Acoustic geodetic measurement at the west end of spreading Okinawa trough back arc basin.

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In this presentation, we show a result of seafloor crustal deformation measurement using GNSS/Acoustic technique conducted off Ilan, Taiwan, from July 2012 to May 2016.

The measurement site is located at the intermediate point between Taiwan and Yonaguni Islands in the west end of the Okinawa trough which is the back arc basin of the South-West Islands of Japan. The east adjacent area of our site, the north off the Yonaguni Island, is known as the region where the back arc spreading is especially fast in the Okinawa trough. The velocity of the GEONET station by Geospatial Information Authority of Japan (GSI) in Yonaguni Island relative to the Eurasian plate from 2010 to 2013 is about 6-7 cm/yr to the south. Institute of Earth Sciences, Academia Sinica deployed the seafloor benchmark consisting of four seafloor transponders which form a square 1,000 m on a side at the southern edge of the trough axis. Our aim is to observe the behavior of the back arc opening at the point very close to the spreading center.

The GNSS/Acoustic measurement were conducted eight times using observation vessel during four years from July 2012 to May 2016. For each measurement, we obtained 3D coordinate of the onboard GPS antenna and the vessel attitude both with interval of 0.2 sec, two way acoustic travel time and CTD. These data are combined and processed using the method proposed by Ikuta et al. (2008) to solve position of the seafloor benchmark. The 3D coordinate of GPS antenna was solved using IT (Interferometry Trajectory) which is the software suitable especially for long baseline measurement developed by NASA/GSFC. On the benchmark positioning by method of Ikuta et al. (2008), we introduced an assumption that the relative position of the four seafloor transponders does not change through all the measurements and estimated the movement of the position of their centroid.

From the result, the velocity of the centroid is 5.7 cm/yr to the southeast with reference to Eurasian plate. The horizontal time series of the centroid shows small deviation that maximum residual is about 7 cm from an approximated straight line. On the other hand, the horizontal time series seems to have an offset in between July and September 2013, so we tried to fit it with two straight lines and evaluated the goodness of fitting with AIC (Akaike's Information Criterion). As a result, the value of AIC was the smallest when the period was divided at the period between July and September, 2013. Fitted by two straight lines, the time series show southward movement of about 11 cm during the period between July and September, 2013. Ando et al. (2015) reported that dyke intrusion accompanying an earthquake swarm occurred at the deepest part of the trough north off Yonaguni Island in April 2013. The southward movement of the centroid off Ilan may show that this back arc spreading event propagated westward during the following 3-5 months. Spreading of the Okinawa trough with apparently constant speed by the observation based on land GNSS of the South-West Islands may occur intermittently without seismic activity near spreading center of the Okinawa trough. When fitted by a straight line, the centroid moves with velocity intermediate between GNSS stations located in Yonaguni Island and Ilan plain, Taiwan. This result suggests that although northern part of Taiwan and the west end of the South-West Islands show very different movement, they does not have significant discontinuity between them.

Keywords: Okinawa trough, back arc spreading, seafloor crustal deformation, GNSS/Acoustic measurement

